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# The effects on mortality of brief interventions for problem drinking: a meta-analysis

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## ABSTRACT

**Aims** Brief interventions for problem drinking may result in decreased mortality rates. Long-term follow-up studies of brief interventions do not produce a clear answer to the question as to whether these interventions reduce mortality or not.

**Methods** We conducted a meta-analysis of randomized studies comparing brief interventions with a control group, using the fixed-effects model. A systematic literature search produced four studies in which the mortality status of subjects was verified at follow-up. Six more studies reported some deaths at follow-up but did not verify mortality in death registers, and 22 further studies did not report the mortality status of the included subjects.

**Findings** The pooled relative risk (RR) of dying was 0.47 for the four studies with verified mortality rates (95% CI: 0.25, 0.89). The pooled RR of all 32 studies was comparable (RR = 0.57; 95% CI: 0.38, 0.84), as were the RRs of several other subsamples of studies. The prevented fraction was 0.33 in the studies with verified mortality rates.

**Conclusions** Although the overall death rate was low in the population of problem drinkers, brief interventions do appear to reduce mortality.

**KEYWORDS** Alcohol consumption, alcoholism, meta-analysis, mortality.

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## INTRODUCTION

In the past three decades, the effectiveness of screening and brief interventions for problem drinking in medical care settings has been examined in dozens of studies. Although there are many differences between the settings, screening procedures and interventions used in these studies, the results generally show comparably positive effects. Several meta-analyses have shown that the results of these interventions have significant effects on problem drinking in the short term, especially in the group with increased levels of alcohol consumption, but less so in subjects with more severe alcohol problems [1–5]. Although the effects in the longer term are less clear [1,6,7], the benefits are generally considered to be well established, and there is broad agreement that screening and brief interventions for problem drinking should be applied routinely in primary care [8,9].

Most studies concentrate on the effects of brief interventions on alcohol use and alcohol-related problems [1]. However, it is also possible that brief interventions may have an effect on mortality rates. It is now well established that limited alcohol consumption results in a decreased risk for coronary heart disease, while increasing consumption leads to increased levels of mortality through chronic conditions such as liver cirrhosis, as well as suicide and accidents [10–12]. It is possible that brief interventions, typically focusing on subjects with increased alcohol consumption, may reduce not only consumption but also the mortality related to increased alcohol consumption.

Three recent long-term studies have examined the effects of brief interventions on mortality [7,13,14]. These three studies have succeeded in examining mortality in the majority of the respondents at 413 years after the intervention. Unfortunately, the results are

conflicting. Two studies did find differences in mortality between experimental and control conditions, but these did not reach significance levels [7,14]. The third study also found a significant effect of brief interventions on mortality [13], but only when the control condition was combined with another comparison group. Furthermore, this study did not use an adequate randomization method, and it is doubtful whether this intervention can be considered to be a brief intervention because the number of sessions and the time span of the intervention were too large.

But, because the number of deaths was relatively small in these studies, it is entirely possible that the reason why significant effects were not found was because the statistical power was insufficient to show any effect.

In this situation, a meta-analysis can help in answering the question as to whether brief interventions have a significant effect on mortality. In a meta-analysis, the results of multiple studies are integrated statistically so that the statistical power is increased. In this study, we present the results of a meta-analysis of the effects of brief interventions on mortality.

## METHODS

### Selection of studies

Studies were traced by means of several methods. Firstly, references relating to earlier meta-analyses and systematic reviews were examined [1–5,9]. Secondly, we conducted a new search in computerized literature databases (Medline, 1966–April 2002; Psychinfo, 1960–April 2002), combining terms indicative of the intervention ('brief intervention', 'physician/GP/general practitioner intervention', 'prevention') and the content of the problem (e.g. 'alcoholism', 'problem/heavy drinking/drink-ers'; both MeSH-terms and textwords, alcohol\*). No language restrictions were used. Unpublished and grey literature was searched by scanning Dissertation Abstracts. Thirdly, reference lists of retrieved papers were screened, and papers that possibly met inclusion criteria were retrieved and studied.

### Inclusion criteria

In order to be included in our meta-analysis, a study had to compare a brief intervention to a no-intervention control group in a group of heavy drinkers, and have at least a pre-test and post-test measurement. Studies had to use some kind of randomization.

The operationalization of brief intervention developed by Moyer and colleagues was used [1]. Their meta-analysis is currently the most comprehensive and well-designed meta-analysis of brief interventions, and their

operationalization of brief interventions represents the current state of knowledge well. Brief interventions consisted of no more than four sessions [15], and included a recommendation to reduce drinking. No limit for contact time regarding the interventions was used, as this is typically not contained in the published reports. Written self-help guides without contact with a provider were also considered to be brief interventions, as were interventions aimed at persuading the subjects to accept more extensive treatment.

Subjects of included studies were typically recruited through screening in health-care settings. Studies of treatment-seeking subjects were excluded, as were studies of subjects who accepted referral to specialized services or who responded to advertisements. Studies in which the control subjects received some form of advice to cut down drinking were also excluded, as were studies examining the interventions designed to encourage pregnant women to stop using alcohol. We also excluded studies in subjects with psychiatric disorders. Furthermore, we only included studies of subjects who did not seek treatment themselves.

We tried to contact the original authors of the studies through e-mail or postal mail in order to obtain additional information about study details, especially on mortality and methods of verifying death rates at follow-up.

### Analyses

#### Follow-up period

Because the follow-up period of the studies varied considerably, we based the calculation of mortality rates on person-years. That is, we divided the number of deaths occurring in the time period (the numerator) by the total amount of person-time units (person-years) of the group at risk (the denominator). Technically, this is known as the person-time incidence rate, or the incidence density rate (IDR). The person-time incidence rate is an appropriate measure of incidence when follow-up times are unequal [16].

#### Statistics

For each study, we calculated the relative risk (RR) of dying in subjects receiving a brief intervention compared with the risk in control subjects. For each study, we also calculated the prevented fraction (PF), which indicates how much the overall mortality rate in the population of problem drinkers can be reduced by the brief interventions. Furthermore, we calculated the numbers needed to treat (NNT). NNT indicates the number of subjects that have to be treated in order to prevent one death. NNT is calculated as  $1/(IDR_1 - IDR_0)$ , where  $IDR_1$  is the

incidence density rate in the experimental group and  $IDR_0$  is the incidence rate in the control group.

### Meta-analyses

In the meta-analyses, we first calculated overall relative risks with the DerSimonian and Laird method [17]. All the sets of comparisons that we examined in the meta-analyses were homogeneous. Therefore, we used the fixed effects model in all analyses [18]. We also conducted all analyses with the random effects model, but scarcely found any differences between the relative risks resulting from the fixed effects model and the random effects model. In this paper, we present only the results from the fixed effects models.

For the analyses, we used the computer program from the Cochrane Collaboration, RevMan (version 4.0.4; the Cochrane Collaboration, Oxford, UK). We calculated the Chi-square statistic to estimate heterogeneity between studies. The other statistics (IDR, PAF, NNT) were calculated using the pooled outcomes of the meta-analyses.

## RESULTS

### Included studies

Thirty-two studies met the inclusion criteria [6,7,14,19–26,28–46]. A total of 7521 subjects were examined in the 32 studies, 4190 in the experimental conditions and 3331 in the control conditions. More than one form of brief intervention was compared with a control condition in 14 studies, resulting in a total of 53 comparisons between experimental and control groups.

The total number of deaths was relatively small. Overall, 46 subjects died in the control groups, compared with 33 in the experimental groups.

### Mortality rates

Three categories of studies could be distinguished:

- 1 Studies with verified death rates ( $n = 4$ ; six comparisons). In these studies, the mortality status of respondents at follow-up was verified through death certificates or other reliable sources.
- 2 Studies reporting some deaths at follow-up, but without verifying the mortality status of respondents at follow-up ( $n = 6$ ; six comparisons). In these studies, more deaths may have occurred during the study than were reported, as subjects who dropped out between pre-test and follow-up may have died without the researchers finding out about it.

In two of these studies, the number of deaths were only reported for the experimental and control groups combined, and the original authors did not inform us as to

how these deaths were divided over the experimental and the control groups. In these cases, we divided the deaths evenly over the conditions depending on the number of subjects in each condition.

- 3 Studies without reported deaths at follow-up ( $n = 22$ ; 41 comparisons). In these studies, some deaths may or may not have occurred during the study among subjects who dropped out.

We decided to conduct the main analyses on the four studies with verified mortality status, as these were the only ones that had reliable data on mortality status. The other studies were used in the analyses, but only to verify the results of these five studies.

The quality of the four studies was rated satisfactory to good. Apart from using a randomized controlled design, all used large sample sizes ( $n > 150$ ); they all used long follow-up measurements ( $\geq 1$  years); they all used adequate methods to verify mortality status, and they used well-designed interventions and adequate analyses. Selected characteristics of these studies are presented in Table 1.

### Meta-analysis

Firstly, we conducted a meta-analysis of the four studies with verified death rates. In this meta-analysis, we used only one comparison between experimental and control condition per study. When two or three interventions were compared to the control condition within one study, these multiple interventions were pooled into one comparison. None of the RRs from individual studies was found to be significantly different from 1. But the pooled RR was significant (0.47; 95% CI: 0.25, 0.89). The results are summarized in Fig. 1. A test of heterogeneity showed that the set of studies in this meta-analysis was homogeneous, as was the case for all meta-analyses in this study (Table 2).

We then conducted a meta-analysis of all studies. The resulting pooled RR was found to be significant ( $RR = 0.57$ ; 95% CI: 0.38, 0.84).

Next, we selected the comparisons from the studies without verified death rates. The resulting pooled RR was still comparable with the RRs of the earlier meta-analyses (0.63; 95% CI: 0.38, 1.06), but did not reach significance. We also selected the studies that reported any deaths and found that the RR of this sample was also comparable (0.52; 95% CI: 0.33, 0.82) and significant.

The total number of comparisons ( $n = 53$ ) was relatively large compared with the total number of studies ( $n = 32$ ). This was due to the 14 studies that compared two or three brief interventions with a control condition. As a sensitivity analysis, we performed meta-analyses in which all comparisons, instead of one comparison per study, were used. Firstly, we conducted a meta-analysis of

**Table 1** Selected characteristics of studies examining effects of brief interventions on mortality (only studies in which mortality data were verified).

Study	Setting	Population	Verification of mortality	Conditions	$n_{\text{rand}}$	$n_{\text{deaths}}$	FU
Fleming et al. (1999) [27]	Screening of consecutive GP patients	Heavy drinking elderly (65+); not dependent	US state and national death registries for subjects who did not participate in follow-up; family member contacts	1. Two GP-delivered sessions (10–15 min each) with advice, education, contracting 2. Control	87 71	1 4	2 years
Fleming et al. (2002) [14]	Screening of consecutive GP patients	Heavy drinking adults (18–65); not dependent	US state and national death registries for subjects who did not participate in follow-up; family member contacts	1. Two GP-delivered sessions (10–15 min each) with advice, education, contracting 2. Control	392 382	3 7	4 years
Wutzke et al. (2002) [7]	General hospital, GPs, health screening programme	Heavy drinking adults (18–69); not dependent	Registry of births, deaths, marriages in New South Wales (Australia)	1. Simple advice (5 min of feedback and advice by therapist) 2. Brief counselling (1 + 15 min of counselling) 3. Extended counselling (2+ two additional counselling sessions within 6 months) 4. Control	154 156 100 144	7 6 3 9	10 years
Chick et al. (1985) [25]	Screening of consecutive patients of four medical wards	Problem drinkers (men; 18–65)	Through contacts with patients' GP	1. Counselling (by nurse; 1 hour; about lifestyle, health, drinking habits) 2. Control	77 77	1 2	1 year

$n_{\text{rand}}$ , number of subjects randomized to conditions;  $n_{\text{deaths}}$ , number of deaths during follow-up; FU, follow-up period; GP, general practitioner.

the six comparisons from the five studies with verified mortality rates. Again, the RR was comparable with the RRs from the earlier meta-analyses (RR = 0.52; 95% CI: 0.31, 0.89) and significant. Then we carried out a meta-analysis of all comparisons from all studies and found that the RR was still comparable (0.69; 95% CI: 0.50, 0.97) and significant.

The IDR in the studies with verified mortality rates was three deaths for each 1000 life years in the brief intervention conditions, compared with seven deaths per 1000 life years in the control conditions. The IDR ranged from three to five deaths per 1000 life years in the intervention conditions, and from seven to eleven deaths in the control conditions. The prevented fraction (PF) ranged from 0.23 to 0.36 in the meta-analyses.

In the studies with verified mortality rates the PF was 0.33, indicating that about one in every three deaths is prevented by the intervention. The numbers needed to be treated (NNT) ranged from 154 to 317; in the studies with verified mortality rates the NNT was 282, indicating that 282 subjects have to be treated in order to prevent one death within a year.

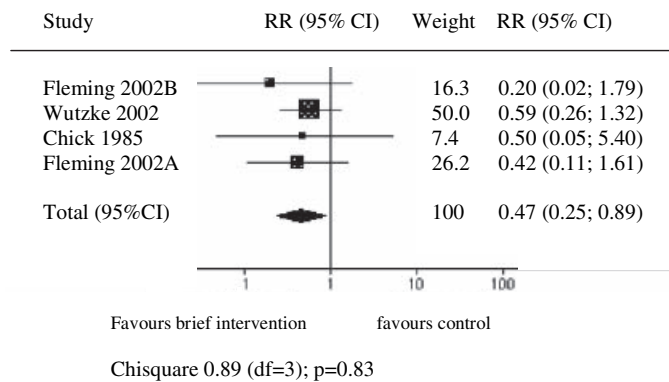
A fail-safe analysis indicated that only one study with an average sample size and a null-finding RR (RR = 1) would have to be found in order to render the mean RR non-significant (resulting RR = 0.63; 95% CI: 0.38, 1.02).

## DISCUSSION

This study has several strengths and limitations. One limitation is that the number of studies that could be used in this meta-analysis was relatively small. Although there is a considerable number of randomized trials examining the effects of brief interventions, relatively few report the death rates between pre-test and follow-up, and even fewer studies have verified the death rates through examination of death registers or comparable methods. On the other hand, the results of the meta-analyses with different subsets of studies are remarkably comparable, indicating some robustness of the results.

A second limitation is that we had to assume that the mortality rates were uniformly distributed over the follow-up periods of the studies. This made it possible to calculate the number of deaths per life-year, which in turn made it possible to compare studies with different follow-up periods. However, it is entirely possible that the deaths were not uniformly distributed over the follow-up period. For example, it is conceivable that the preventive effect of the intervention may be stronger right after the intervention, and less strong in the long term. This could easily cause some distortion of the outcomes. Further-





**Figure 1** Results of meta-analysis of studies examining the effects of brief interventions on mortality (only studies with verified mortality rates)

**Table 2** Meta-analyses of studies examining the effects of brief interventions for problem drinking on mortality.

	$n_{comp}$	RR (95% CI)	$\chi^2$	IDR <sub>BI</sub>	IDR <sub>CTR</sub>	PF	NNT
Studies with verified mortality rates	4	0.47 (0.25, 0.89)	0.89 ns	0.003	0.007	0.33	282
All studies	32	0.57 (0.38, 0.84)	6.24 ns	0.004	0.008	0.32	243
Studies without verified mortality rates	28	0.63 (0.38, 1.06)	4.60 ns	0.004	0.009	0.28	217
Studies with reported mortality rates	10	0.52 (0.33, 0.82)	5.12 ns	0.005	0.011	0.36	154
All comparisons from studies with verified mortality rates	6	0.52 (0.31, 0.89)	2.16 ns	0.004	0.007	0.23	317
All comparisons from all studies	53	0.69 (0.50, 0.97)	10.22 ns	0.004	0.007	0.23	309

$n_{comp}$ , number of comparisons; IDR<sub>BI</sub>, incidence density rate in subjects receiving a brief intervention; IDR<sub>CTR</sub>, incidence density rate in control subjects; PF, prevented fraction; NNT, numbers needed to be treated; ns, not significant.

more, mortality rates are not constant over time, nor are they constant within populations, and they may vary at different times and for different subpopulations.

A third limitation is that the interventions, the designs of the studies, the populations and the measurement instruments of the studies differ considerably. In particular, the contents of the interventions seem to be an area of concern because differing elements are included, varying from simple advice to reduce drinking to brief counseling. On the other hand, we conducted several sensitivity analyses in which specific studies and sets of studies were excluded, but all resulted in comparable outcomes. We also found that all the meta-analyses conducted indicated that this was a homogeneous set of studies and comparisons. However, tests of homogeneity may be underpowered and misleading in small samples of studies such as this.

A fourth limitation is that we could only use unadjusted data on the mortality rates. Corrections for important confounding variables could not be made.

A fifth limitation is the risk of publication bias. We did not find any dissertation or paper in a language other than English that could be included in the meta-analysis. Because the number of studies with verified death rates was small, even a few missed studies could influence the results of our meta-analysis considerably.

A sixth limitation is that we can not check the reliability of the methods with which the mortality rates were verified. Although all of the four major studies used a

method that can be considered to be reliable, such as checking death registries, it can not completely be ruled out that some deaths have occurred that were not found through these methods.

Because of these limitations, and because a fail-safe analysis showed that only one study with no effect has to be found to render the mean RR non-significant, the results of this study should be considered with much caution. Clearly, more long-term research is necessary to confirm the results.

Despite these limitations, we did find clear indications that brief interventions do have an effect on mortality. On the basis of this meta-analysis, we can estimate that the mortality of problem drinkers is reduced by about 23–36% in the population of problem drinkers, which is considerable. This is an important finding—primarily, of course, because of the clinical relevance. Such a reduction of mortality is sizeable. This is one more reason why screening and brief interventions should be applied routinely in medical settings, apart from the other benefits of brief interventions for alcohol use and alcohol-related problems that have been shown by earlier studies. Secondly, it illustrates that psychosocial interventions can have an important impact on patients, not only on psychosocial outcomes but also on mortality.

It is not clear through which mechanisms brief interventions reduce mortality. Brief interventions have effects on alcohol use and alcohol-related problems, morbidity related to alcohol use, social harm and risky behaviors. It

is not clear which of these effects result in the reduced mortality.

One of the major problems in examining how brief interventions reduce mortality is that alcohol-related mortality is generally underestimated because of classification procedures [48,49]. Through these procedures only causes directly related to alcohol are accounted for, while indirect causes are not [13]. Therefore, and because of the lack of empirical data, it is currently not possible to determine how brief interventions reduce mortality.

This study once again points to the importance of screening and brief interventions in medical settings and for public health in general. It is not yet clear what is the best dissemination strategy for brief interventions [50], and it is difficult for general practitioners and other health professionals to implement these procedures [51]. But there is no doubt that rapid dissemination and implementation of these interventions is very important. This study indicates that delaying dissemination will probably result in avoidable deaths.

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